

Marine microbial mats and the search for evidence of life in deep time and space

David J. Des Marais

Exobiology Branch, NASA Ames Research Center, Moffett Field, CA 94035

Cyanobacterial mats in extensive seawater evaporation ponds at Guerrero Negro, Baja California, Mexico, have been excellent subjects for microbial ecology research. The studies reviewed here have documented the steep and rapidly changing environmental gradients experienced by mat microorganisms and the very high rates of biogeochemical processes that they maintained. Recent genetic studies have revealed an enormous diversity of bacteria as well as the spatial distribution of Bacteria, Archaea and Eukarya. These findings, together with emerging insights into the intimate interactions between these diverse populations, have contributed substantially to our understanding of the origins, environmental impacts, and biosignatures of photosynthetic microbial mats. The biosignatures (preservable cells, sedimentary fabrics, organic compounds, minerals, stable isotope patterns, etc.) potentially can serve as indicators of past life on early Earth. They also can inform our search for evidence of any life on Mars. Mars exploration has revealed evidence of evaporite deposits and thermal spring deposits; similar deposits on Earth once hosted ancient microbial mat ecosystems.